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THE CRICETID RODENTS DESCRIBED BY LEIDY AND COPE FROM THE TERTIARY OF NORTH AMERICA

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In the course of studying the fossil Cricetids of North America in an attempt to unravel their evolution, it was immediately obvious that very little progress could be made until the original type specimens had been restudied and refigured, due to the inadequate nature of the original figures and descriptions of these small rodents. An opportunity to study these fossils was presented while I was Cutting Traveling Fellow in Columbia University. This study was further assisted by a grant from the Marsh Fund of the National Academy of Sciences. I wish to express my thanks to the authorities of the American Museum of Natural History, the United States National Museum, and The Philadelphia Academy of Natural Science for permission and facilities to study these specimens. The illustrations are by the author.

Eumys elegans Leidy, 1856

Figure 1, and Leidy, 1869, Pl. xxvi, figs. 12–13

Genoholotype.—Acad. Nat. Sci. Phila. No. 11027, left mandible with M_2, part of M_1, and alveolus of M_3.

Horizon and Locality.—Middle Oligocene Brule of South Dakota.

Diagnosis.—M_2 quadrate, longer than broad; anterior cingulum continuous across whole front of tooth, with subequal buccal and lingual moities; posterior arm of protoconid free from both metaconid and entoconid, reaching almost to lingual margin of the tooth; central cusp small, with no lingual crest and very weak buccal one; hypoconulid apparently reduced; posterior cingulum reaching entoconid upon wear.

The characters as listed above are found in a considerable number of the Oligocene rodents hitherto referred to this species, though by no means in a majority. The specimen figured by Schaub (1925, Pl. II, fig. 16) is distinguished from *E. elegans* by the shortness of the posterior arm of the protoconid, by the well-developed buccal crest of the central cusp, and by a slight difference in the shape of the tooth, the posterior half being slightly buccad of the anterior. This last difference seems of little importance, but the first two would probably warrant specific sepa-

ration, when taken together with the differences doubtless existing in the rest of the animal. A consideration of this question, as well as of the phylogenetic position of *E. elegans*, is reserved for a future study. According to Schaub's interpretation of the phylogenetic sequence of Cricetids, however (Schaub, 1925), the small size of the central cusp (Schaub's "mesostylid"), and particularly the absence of the lingual crest of the central cusp (Schaub's "mesostylidsporn"), together with the length of the posterior arm of the protoconid, would be progressive characters, indicating advances over the conditions found in the most primitive forms of *Cricetodon*. The feature in which this genus is most clearly separated from *Cricetodon* is in the length of the posterior arm of the protoconid, which is longer than the lingual crest of the central cusp, a condition never seen in *Cricetodon* (Schaub, 1925).

Fig.1
Acad.Nat.Sci. No.11027

Fig.2
A.M.N.H. No.7018

Fig.3
A.M.N.H. No.7028

Fig.4
A.M.N.H. No.7022

Fig.5
U.S.N.M. No.1204

Fig. 1. *Eumys elegans*, Leidy. Holotype, M_2 left, ×10. Acad. Nat. Sci. Phila., No. 11027.

Fig. 2. *Leidymys nematodon* (Cope). Holotype, M^{1-3} left, ×5. A.M.N.H. No. 7018.

Fig. 3. *Leidymys lockingtonianus* (Cope). Holotype, M^{1-3} right, reversed, ×5. A.M.N.H. No. 7028.

Fig. 4. *Paciculus insolitus* Cope. Holotype, M^{1-2} right, reversed, ×5. A.M.N.H. No. 7022.

Fig. 5. *Copemys loxodon* (Cope). Holotype, M_{1-2} right, ×5. U.S.N.M. No. 1204.

LEIDYMYS, NEW GENUS

GENOTYPE.—*Hesperomys nematodon*, Cope, 1879, a species represented by a skull with the cheek teeth, from the Upper Oligocene Middle John Day Beds of Oregon.

DIAGNOSIS.—Skull roof flat, with temporal crests widely spaced, and showing no signs of convergence, as is the case in *Eumys;* M^{1-2} not essentially different from those of *Eumys;* M^3 large, with well-developed hypocone, posterior cingulum, and exceptionally large central cusp and associated crests.

SPECIES.—*Leidymys nematodon* (Cope) and *L. lockingtonianus* (Cope), both from the Middle John Day.

Leidymys nematodon (Cope), 1879

Figure 2, and Cope, 1885, Pl. LXVI, figs. 33–33*a*

Hesperomys nematodon Cope, 1879.
Eumys nematodon (Cope), Cope, 1881*a*.
Hesperomys nematodon Cope, Cope, 1881*c*.
Peromyscus nematodon (Cope), Hay, 1902.

HOLOTYPE.—A.M.N.H. No. 7018.

HORIZON AND LOCALITY.—Upper Oligocene Middle John Day Beds of the John Day River, Oregon.

DIAGNOSIS.—Skull top with broad level area between temporal crests; cusps of molars rounded as in *Eumys;* two crests from protocone to anterocone of M^1; central cusp indistinct, with well-developed buccal crests, which do not, however, reach the buccal margin of the tooth except on M^3; cingula complete on all teeth; slight dams across median valleys of M^{1-2}.

This species is clearly distinct from skulls which may unhesitatingly be referred to *Eumys*, on the basis of the skull top and the third upper molar. No specimen of *Eumys* with which I am familiar shows anything except the simple sagittal crest, whereas this form has paired temporal crests extending well behind the orbit, which never unite to form a sagittal crest but remain as clearly defined ridges following the superior border of the orbit. This cannot be an age character, as the type of *L. nematodon* has fairly well-worn teeth, and specimens of *Eumys* with much less worn teeth have quite different arrangement of the crests. Nor can it be a sexual difference, as it seems most unlikely that one sex should be found only in Oregon, while the other was found throughout the Great Plains deposits.

The type of M^{1-2} falls within the range of variation that might be allowable for *Eumys*, the distinctions that could be made being probably of no more than specific value. In M^3, however, the two genera are quite distinct. M^3 of *Leidymys* has a well-developed hypocone, though it is smaller than in the first two molars. This cusp is either absent or essentially aborted in the third molar of *Eumys*. In connection with this, the lingual valley of M^3 in *Eumys* runs anterad as in M^{1-2}, whereas

in *Leidymys* it is directed posterad. The central cusp of this tooth is also very well developed, sending a crest to the postero-external margin of the tooth. There is thus some similarity between M^3 of *L. nematodon* and that of *Plesiosminthus myarion* (Schaub, 1930, Fig. 6). The upper incisors of *L. nematodon* are smooth and rounded, though not as round as in specimens referable to *Eumys*, and are quite distinct from those of *Plesiosminthus*.

Leidymys lockingtonianus (Cope), 1881

Figure 3, and Cope, 1885, Pl. LXIV, figs. 10–10*e*

Eumys lockingtonianus Cope, 1881*a*.

Paciculus lockingtonianus (Cope), Cope, 1881*b*.

HOLOTYPE.—A.M.N.H. No.7028, a fairly complete skull.

HORIZON AND LOCALITY.—Upper Oligocene Middle John Day, The Cove, John Day River, Oregon.

DIAGNOSIS.—Tooth pattern similar to that of *L. nematodon*, as far as can be told; supraorbital crests much weaker; upper incisors compressed, with no grooves, but with two faint ridges toward the lateral side.

The teeth of this specimen are so badly worn that very few characters are visible. The buccal crest of the central cusp clearly reaches almost to the buccal margin of the tooth, as in *L. nematodon*, and the general configuration, particularly of the third molar, is quite different from that of *Eumys*. There is no trace of the antero-posterior compression of the paracone and metacone, which seems to be characteristic of *Paciculus*, nor is the buccal crest of the central cusp as long as in that genus. There is a faint crest near the center of the upper incisor, and a rather stronger one at the buccal side, features which have not been observed in any other North American Tertiary Cricetids.

The infraorbital foramen seems much larger and more Dipodid in appearance than in the Cricetids, which was doubtless one basis for Hay's reference of this form to the Zapodidae. A large part of this resemblance, however, is due to breakage of the foramen in the fossil, although there seem to have been some differences from the type of foramen found in *Eumys*. The anterior palatine foramina are very large, as are also the auditory meatus and the interparietal.

Paciculus insolitus Cope, 1879

Figure 4, and COPE, 1885, Pl. LXVI, Figs. 31–32

GENOHOLOTYPE.—A.M.N.H. No.7022, palate with M^{1-2} of both sides.

HORIZON AND LOCALITY.—Upper Oligocene Middle John Day Beds, The Cove, John Day River, Oregon.

DIAGNOSIS.—M^{1-2} with five compressed transverse crests, all of subequal width and length; paracone and metacone little if any more prominent than central cusp; all five crests subparallel; protocone uniting with lingual margin of anterocone.

The tooth pattern of this form is close to that of *Leidymys* and *Eumys* in some respects, but differs rather fundamentally in the great anteroposterior compression of the paracone and metacone, a character not seen among contemporary Cricetids, but found among the Sicistids. It is this, in part, that has led Hay (1902) to assign this genus to the Zapodidae. There is, however, no trace of P^4, and the large anterocone of M^1 indicates that there has been a considerable lapse of time since the premolar was lost. The teeth are shorter and narrower than in *Leidymys*, but the difference is probably too small to have much significance. The palate is short, as in *Leidymys*.

There is a considerable resemblance between *Paciculus* and some of the more primitive Sicistids, especially *Plesiosminthus myarion* from the Aquitanian (Schaub, 1930). The elongation of the central crest and the pentalophoid character of the tooth are Sicistid features. There is, however, sufficient distinction in the anterior end of the tooth row, and particularly in the entire absence of the upper premolar, so that there is no question but that this form cannot belong to either the Sicistidae or the Zapodidae, and is certainly nearer to the Cricetidae than to any other group. Moreover, the valley between the paracone and the anterior cingulum of the second molar opens freely at its buccal end, instead of being closed as in *Plesiosminthus*. The reference of this form to the Cricetidae is strengthened by the occurrence of a very similar type among the European members of the family, *Heterocricetodon stehlin* (Schaub, 1925, Pl. IV, fig. 7) having a very similar type of pattern, though derived from a different source from that of *Paciculus*.

COPEMYS, NEW GENUS

GENOTYPE.—*Eumys loxodon* Cope, 1874*a*.

DIAGNOSIS.—Lower molars tending toward alternation of external and internal cusps; central cusp apparently absent; posterior arm of protoconoid of M_1 extended as crest to lingual margin of tooth; protoconoid free from metaconoid; no hypoconulid on M_2, posterior cingulum arising from external border of hypoconid.

Copemys loxodon (Cope), 1874

Figure 5, and Cope, 1877, Pl. LXIX, fig. 15

Eumys loxodon, Cope, 1874*a*.
Hesperomys loxodon (Cope), Cope, 1874*b*.
Eumys loxodon Cope, Cope, 1875.
Eumys loxodon Cope, Allen, 1877.

Peromyscus loxodon (Cope), Hay, 1902.
HOLOTYPE.—U.S.N.M. No. 1204, lower jaw with M_{1-2} right.
HORIZON AND LOCALITY.—Santa Fé Miocene or Pliocene Beds of New Mexico.
DIAGNOSIS.—The same as that given above for the genus.

This species has had rather a varied taxonomic history, as indicated above. It differs materially from *Hesperomys* and *Peromyscus* in having more brachydont teeth, the crowns being little if any higher than in *Eumys*. The alternation of the cusps, while at first suggestive of a tendency toward the *Peromyscus* pattern, is, however, actually leading in a rather different direction. The peculiar position of the posterior cingulum of M_2 is like nothing with which I am familiar. It is possible that the long central crest is a growth from the central cusp, and it is also possible that it represents merely the posterior arm of the protoconid.

There can be no question but that this form represents a genus that is much more progressive than *Eumys*, and one that is fairly specialized in its own direction, though that direction does not appear to be toward any other late Tertiary or recent group of Cricetids, with the exception of certain species from the Miocene and Pliocene of California and Nevada, which have been described as *Peromyscus*.

DENTAL MEASUREMENTS

(all measurements in millimeters)

TABLE I. UPPER TEETH

	Leidymys nematodon A.M.N.H. No. 7018	*Leidymys lockingtonianus* A.M.N.H. No. 7028	*Paciculus insolitus* A.M.N.H. No. 7022
M^{1-3}	6.41	6.78	5.65
M^1, antero-posterior	2.61	2.77	2.32
width, anterior loph	0.89	1.11	1.82
width, protoloph	1.75	1.94	1.90
width, metaloph	1.79	1.98	1.90
M^2, antero-posterior	2.02	2.09	1.94
width, protoloph	1.86	2.08	2.01
width, metaloph	1.83	1.94	1.89
M^3, antero-posterior	1.83	1.84	..
width, protoloph	1.83	1.84	..
width, metaloph	1.50	1.48	..

TABLE II. LOWER TEETH

	Eumys elegans A.N.S.Phila. No. 11027	*Copemys loxodon* U.S.N.M. No. 1204
M_{1-3}, alveolar length	7.00	..
M_1, antero-posterior	..	1.70
width, metalophid	..	1.10
width, hypolophid	..	1.15
M_2, antero-posterior	2.26	1.57
width, metalophid	1.96	1.22
width, hypolophid	1.95	1.27

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